51. The method as defined in claim 24, wherein said process provides a yield of single-walled carbon nanotubes greater than about 20 wt%.

52. The method as defined in claim 24, wherein said process provides a yield of single-walled carbon nanotubes greater than about 50 wt%.

53. The method as defined in claim 24, wherein said metal containing catalysts have diameters ranging from 1-10 nm.

REMARKS

A Preliminary Amendment was filed on June 29, 2000 (the "Preliminary Amendment") with the filing of this continuation application which contained new claims 24-55 (attached hereto as Exhibit A). However, it appears that this Preliminary Amendment was not considered since the Official Action only referred to the original claims 1-23 as filed. In view of this oversight, Applicants have herewith submitted all of the pending claims 1-22 and 24-53. Claims 23, 54 and 55 have been cancelled without prejudice.

In the Preliminary Amendment (and thus along with this Amendment), Applicants also sought to correct the citations to certain references mentioned in the specification. No new matter is added.

No additional fees are due for claims 24-53 as a check in the amount of $327.00 was submitted on June 29, 2000 to cover all of the new claims 24-55 (attached as Exhibit A).

Reconsideration and withdrawal of the rejections of the pending claims 1-22 are respectfully requested in view of the Amendment submitted herewith. The Examiner rejected claim 23 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over the Kiang et al. article. In view of the cancellation of claim 23 without prejudice, this issue is moot.

I. Provisional Rejection Of Obviousness-Type Double Patenting

The Examiner rejected claims 1-22 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-75 of U.S. Patent No. 6,221,330.

Applicants note with gratitude that pending claims 2, 3, 10, 11, 15, 16, 18, 20 and 22 were indicated to be allowable over the prior art. Applicants will consider offering to file a terminal disclaimer to overcome the obviousness-type double patenting once the remaining pending claims 1, 4-9, 12-14, 17, 19, 21, and 24-53 have also been determined to be allowable over the cited art. Thus, the Examiner is respectfully asked to hold this issue in abeyance until these claims are all otherwise allowable.

II. Sen Fails To Render Applicants' Claims Unpatentable

The Examiner rejected claims 1, 4-9, 12-14, 17, 19, 21 and 23 under 35 U.S.C. § 102(a) as being anticipated or in the alternative under 35 U.S.C. § 103(a) over the article by Sen et al.

Applicants submit that a prior art reference must contain all the elements for the claimed invention to "anticipate" the claimed invention. *Lewmar Marine Inc. v. Barient Inc.*, 3 U.S.P.Q. 2d 1766 (Fed. Cir. 1987). Missing elements may not be supplied by the knowledge of one skilled in the art or the disclosure of another reference. See *Structural Rubber Prods. Co. v. Park Rubber Co.*, 749 F.2d 707, 716 (Fed. Cir. 1984). To establish *prima facie* obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974); MPEP § 2143.03.

Not only must a prior art reference contain all the elements of the claimed invention to anticipate or render obvious the claimed invention, but it must also be enabling. *Beckman Instruments Inc. v. LKB Produkter AB*, 892 F. 2d 1547, 1551, 13 USPQ2d 1301, 1304 (Fed. Cir. 1989) ("A prior art reference must be enabling...it must provide a description sufficient to teach a

person of ordinary skill in the art how to make and use the apparatus or process"). Sen does not teach the production of single wall nanotubes nor does Sen disclose all of the process limitations as claimed in the present application. Sen certainly does not mention or suggest anywhere single wall carbon nanotubes having diameters less than about 3 nanometers. At best, Sen only speculates that single wall nanotubes can be generated by his process. Sen states on p. 279, col. 2, lines 7-10 (emphasis added), that

> By adjusting the relative concentrations of ferrocene and benzene in the vapour phase it should be possible to preferentially obtain single-walled nanotubes by this technique.

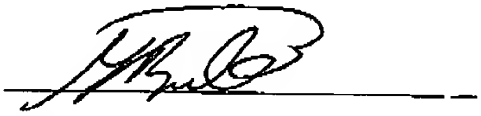
Sen's speculation of the possibility of making single wall nanotubes is not enabling for generating single wall nanotubes. The fact that Sen did not obtain single wall nanotubes even though they were preferred, confirms that his teaching is not enabling for generating single wall nanotubes. Further confirmation of the nonenablement of Sen's teaching is the fact that no other person of ordinary skill in the art demonstrated the generation of single wall nanotubes by the claimed process at the time of Applicants' invention.

While Sen may have suggested that it is possible to obtain single wall nanotubes, obvious to try is not the standard for determining obviousness. *In re O'Farrell*, 7 U.S.P.Q. 2d 1673 (Fed. Cir. 1988); *Ecolochem, Inc. v. Southern California Edison Co.*, 56 U.S.P.Q. 2d 1065 (Fed. Cir. 2000). Accordingly, the teachings of the Sen reference or any other reference at the time of the invention was made does not render the presently claimed subject matter unpatentable.

Therefore, Applicants respectfully submit that the rejection under 35 U.S.C. §§ 102(b) and 103(a) is improper and should be withdrawn.

Respectfully submitted,

KRAMER LEVIN NAFTALIS & FRANKEL LLP
Attorneys for Applicants
919 Third Avenue
New York, New York 10022

By: 

Barry Evans, Reg. No. 22,802
Gerard Bilotto, Reg. No. P-51,474
Phone: (212) 715-9100
Fax: (212) 715-8000

PATENT
100647-03840

EXHIBIT A

Preliminary Amendment
and
copy of check

(filed June 29, 2000)

PATENT
0064738-0040

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Moy et al.
Serial No.	:	Not Assigned (Continuation of Serial No. 08/910,495)
Filed	:	Herewith
For	:	*Process for Producing Single Wall Nanotubes Using Unsupported Metal Catalysts and Single Wall Nanotubes Produced According to this Method*
Art Unit	:	Not Assigned
Examiner	:	Not Assigned

200 Park Avenue
New York, New York 10166

EXPRESS MAIL

Mailing Label Number EL 128511355 US
Date of Deposit June 29, 2000
I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, BOX APPLICATION, Washington, D.C. 20231

Victoria Ayer
(Typed or printed name of person mailing paper or fee)

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to the issuance of the first Office Action in this application, please amend the application as follows:

IN THE SPECIFICATION:

Page 2, line 11, please change "Obelm" to -- Oberlin --.

Page 4, line 7, after the term "also describes" please insert -- in a later publication --.

Page 5, line 10, change "-1200°C" to — 1200°C --.

Page 5, line 13, please delete "(1)".

IN THE CLAIMS:

Please add the following new claims:

– 24. A method for producing hollow, single-walled carbon nanotubes having diameters less than about 3 nanometers by catalytic decomposition of one or more gaseous carbon compounds comprising the steps of:

(1) forming a gas phase mixture of:

(a) a carbon feed stock gas comprising one or more gaseous carbon compounds, each said compound having one to six carbon atoms and only H, O, N, S or Cl as hetero atoms, optionally admixed with hydrogen, a diluent or mixtures thereof; and

(b) a gas phase metal containing compound which is unstable under reaction conditions for said catalytic decomposition, and which forms metal containing catalysts which act as decomposition catalysts under reaction conditions; and

(2) conducting said catalytic decomposition reaction under decomposition reaction conditions and thereby producing said hollow, single-walled carbon nanotubes having diameters less than about 3 nanometers.

25. A method for producing hollow, single-walled carbon nanotubes having diameters less than about 3 nanometers comprising the steps of:

(1) forming a gas phase mixture of:

(a) a carbon feed stock gas comprising one or more gaseous carbon compounds, each said compound having one to six carbon atoms and only H, O, N, S or Cl as hetero atoms, optionally admixed with hydrogen, a diluent or mixtures thereof; and

(b) a gas phase metal containing compound which forms metal containing catalysts which act as decomposition catalysts under reaction conditions; and

(2) conducting a reaction under said reaction conditions and thereby producing said hollow, single-walled carbon nanotubes having diameters less than about 3 nanometers.

26. The method as defined in claim 24, wherein said carbon feedstock gas comprises carbon monoxide.

27. The method as defined in claim 24, wherein said carbon feedstock gas consists essentially of carbon monoxide.

28. The method as defined in claim 24, wherein said decomposition reaction occurs at temperatures between approximately 400°C and approximately 1300°C.

29. The method as defined in claim 24, wherein said decomposition reaction occurs at temperatures between approximately 400°C and approximately 1100°C.

30. The method as defined in claim 24, wherein said decomposition reaction occurs at temperatures between approximately 400°C and approximately 900°C.

31. The method as defined in claim 24, wherein said decomposition reaction occurs at temperatures between approximately 700°C and approximately 1300°C.

32. The method as defined in claim 24, wherein said decomposition reaction occurs at temperatures between approximately 700°C and approximately 1100°C.

33. The method as defined in claim 24, wherein said decomposition reaction occurs at temperatures between approximately 700°C and approximately 900°C.

34. The method as defined in claim 24, wherein said decomposition reaction occurs at a pressure range of approaching 0 p.s.i.g. through approximately 100 p.s.i.g.

35. The method as defined in claim 24, wherein said gas phase metal containing compound is mixed with said feedstock by direct injection.

36. The method as defined in claim 24, wherein said gas phase metal containing compound is in the form of an aerosol.

37. The method as defined in claim 24, wherein said gas phase metal containing compound is a metal carbonyl.

38. The method as defined in claim 24, wherein said gas phase metal containing compound comprises iron carbonyl.

39. The method as defined in claim 24, wherein said gas phase metal containing compound comprises molybdenum carbonyl.

40. The method as defined in claim 24, wherein said gas phase metal containing compound comprises cobalt carbonyl.

41. The method as defined in claim 24, wherein said gas phase metal containing compound is $Mo(CO)_6$.

42. The method as defined in claim 24, wherein said gas phase metal containing compound is $Co_2(CO)_8$.

43. The method as defined in claim 24, wherein said gas phase metal containing compound is a volatile iron compound.

44. The method as defined in claim 43, wherein said volatile iron compound is ferrocene.

45. The method as defined in claim 24, wherein said gas phase metal containing compound is a volatile manganese compound.

46. The method as defined in claim 45, wherein said volatile manganese compound is methylcyclopentadienyl manganese tricarbonyl.

47. The method as defined in claim 24, wherein said gas phase metal containing compound is a volatile cobalt compound.

48. The method as defined in claim 47, wherein said volatile cobalt compound is cyclopentadienyl cobalt dicarbonyl.

49. The method as defined in claim 24, wherein said gas phase mixture consists essentially of said carbon feed stock gas and said gas phase metal containing compound, optionally admixed with hydrogen, a diluent or mixtures thereof.

50. The method as defined in claim 24, wherein said carbon nanotubes have diameters ranging from about 1 to about 3 nanometers.

51. The method as defined in claim 24, wherein said process provides a yield of single-walled carbon nanotubes greater than about 20 wt%.

52. The method as defined in claim 24, wherein said process provides a yield of single-walled carbon nanotubes greater than about 50 wt%.

53. The method as defined in claim 24, wherein said metal containing catalysts have diameters ranging from 1-10 nm.

54. The single-walled carbon nanotubes as defined in claim 23, wherein said carbon nanotubes have diameters less than about 3 nanometers.

55. The single-walled carbon nanotubes as defined in claim 23, wherein said carbon nanotubes have diameters ranging from about 1 to about 3 nanometers. –

REMARKS

Claims 1-23 were pending in the parent application as originally filed. By this Preliminary Amendment, claims 24-55 have been added to further define the present invention. No new matter has been added.

Enclosed is a check in the amount of $327.00 for the thirty-two (32) additional claims in excess of twenty (20) and one (1) additional independent claim in excess of three (3). It is believed that no additional fee is deemed necessary for entry of this Preliminary Amendment and claims herewith. However, the Commissioner is hereby authorized to charge any additional fees required or debit any overpayment to Deposit Account No. 50-0297.

This Preliminary Amendment places the claims in better condition for examination and subsequent Notice of Allowance, the early notification of which is respectfully solicited.

Respectfully submitted,

WHITMAN BREED ABBOTT & MORGAN LLP
Attorneys for Applicants

By: _____

Barry Evans
Registration No. 22,802
John E. Boyd
Registration No. 38,055
(212) 351-3305

PATENT
100647-03840

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Moy et al.
Serial No.	:	09/607,126
Filed	:	June 29, 2000
For	:	**PROCESS FOR PRODUCING SINGLE WALL NANOTUBES USING UNSUPPORTED METAL CATALYSTS AND SINGLE WALL NANOTUBES PRODUCED ACCORDING TO THIS METHOD**
Art Unit	:	1754
Examiner	:	Stuart L. Hendrickson

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on August 20, 2002

Gerard Bilotto, Reg. No. P-51, 474
Name of Applicant, Assignee or Registered Representative

Signature

August 20, 2002
Date of Signature

AMENDMENT UNDER 37 CFR § 1.111

Marked up version

Commissioner for Patents
Washington, D.C. 20231

Sir:

This is the marked up version of the specification and claims amended in response to the Official Action mailed February 22, 2002.

IN THE SPECIFICATION

Pursuant to 37 C.F.R. 1.121(b)(1) please replace the following paragraphs as indicated; the changes for additions are underlined and deletions are in square brackets.

On page 2 of the specification, first full paragraph, lines 5-12:

Carbon fibrils were seen to originate from a metal catalyst particle which, in the presence of a hydrocarbon containing gas, became supersaturated in carbon. A cylindrical ordered graphitic core is extruded which immediately became coated with an outer layer of pyrolytically deposited graphite. These fibrils with a pyrolytic overcoat typically have diameters in excess of 0.1μ. [(Obelm, A. and Endo, M., J.Crystal Growth, 32:335-349 (1976).)] (Oberlin, A. and Endo, M., *J. Crystal Growth*, 32:335-349 (1976)).

On page 4 of the specification, first full paragraph, lines 4-11:

Multi-walled carbon nanotubes of a morphology similar to the catalytically grown fibrils described above have been grown in a high temperature carbon arc [(Iijima, Nature 354 56 1991)] (Iijima, *Nature* 354:56 1991). (Iijima also describes in a later publication arc-grown single-walled nanotubes having only a single layer of carbon arranged in the form of linear Fullerene.) It is now generally accepted [(Weaver, Science 265 1994)] (Weaver, *Science* 265: 1994) that these arc-grown nanofibers have the same morphology as the earlier catalytically grown fibrils of Tennet.

On page 5 of the specification, first full paragraph, lines 4-12:

Smalley (Thess, A., Lee, R., Nikolaev, P., Dai, H., Petit, P., Robert, J., Xu, C., Lee, Y.H., Kim, S.G., Rinzler, A.G., Colbert, D.T., Scuseria, G.E., Tonárek, D., Fischer, J.E.,

and Smalley, R.E., Science, 273: 483-487 (1996)) also describes a process for production of single-walled carbon nanotubes in which a graphite rod containing a small amount of transition metal is laser vaporized in an oven at about [-1200°C] 1200°C. Single-wall nanotubes were reported to be produced in yields of more than 70%.

On page 5 of the specification, second full paragraph, lines 13-17:

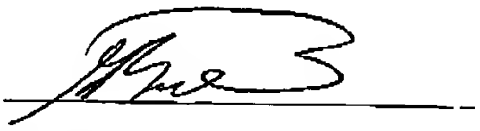
Each of the techniques described above employs [(1)] solid carbon as the carbon feedstock. These techniques are inherently disadvantageous. Specifically, solid carbon vaporization via electric arc or laser apparatus is costly and difficult to operate on the commercial or industrial scale.

IN THE CLAIMS

14. (Amended) The method of claim 13, wherein said volatile iron compound is [ferocene] ferrocene.

Respectfully submitted,

KRAMER LEVIN NAFTALIS & FRANKEL LLP
Attorneys for Applicants
919 Third Avenue
New York, New York 10022

By: 

Barry Evans, Reg. No. 22,802
Gerard Bilotto, Reg. No. P-51,474
Phone: (212) 715-9100
Fax: (212) 715-8000